BREAST SELF EXAMINATION TRAINING THROUGH THE USE OF MULTIMEDIA: A BENCHMARK MULTIMEDIA DEVELOPMENT METHODOLOGY FOR BIOMEDICAL APPLICATIONS

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Abstract – **This paper discusses the development of a set of specifications for a development methodology for educational multimedia, specifically for the development of a prototype educational multimedia application for Breast Self Examination (BSE) training. In the paper, the need for BSE training is examined and BSE is briefly presented. Our focus, however, is to show how the development of a multimedia authoring methodology could provide an effective solution to BSE and other biomedical training needs. A method for setting the overall specifications for a multimedia development methodology for biomedical applications, in general, and a BSE training multimedia application, in particular, is presented.**

Keywords - **Breast cancer, multimedia systems**

I. INTRODUCTION

The development of any software application is subject to development tools and methodologies [1]. General software development usually follows well-established sets of rules that have been identified as best practices for good development. Unfortunately such development methodologies are not available for multimedia software production [2] and the developer is usually left with the task of establishing his or her own development approaches prior to developing a multimedia application [3]. Research indicates that the formulation of a development methodology for multimedia applications that addresses all the different areas of multimedia (user interface, human computer interaction, usage of video and animation, sound, text, etc), which are not usually present in other software applications will be of great benefit to multimedia developers and multimedia application users.

In order to generate a methodology there is a clear need to identify a set of design specifications for it, i.e., what the methodology should address and how it will address it in terms of development. In this paper we will discuss the need for a development methodology for educational multimedia and describe a method for formulating specifications for multimedia development that will be specifically applied to the development of a prototype educational multimedia application for the education and training of the female population on performing breast self examination.

Breast self examination (BSE) is a non-invasive method for diagnosing breast cancer at the early stages of the disease [4], which improves the possibilities of successful treatment. Women are not formally trained to perform BSE until they visit a doctor, which in most cases means that the disease has already advanced. Even at such an advanced stage, BSE may be used to monitor any changes/progress of the disease. Statistics clearly show that breast cancer can be successfully treated if detected early. This could be achieved by using a multimedia application to effectively educate and train the female population on how to perform BSE.

The purpose of this application is to evaluate whether the specifications that are set for an educational multimedia development methodology are appropriate for creating a generally effective educational multimedia content.

Multimedia technology enhances computer presentations by introducing all or some (but at least two) of the following elements [5]:

- Audio
- Video
- Animation
- Text
- Still images

All of the above elements are used to improve communication between the presenter and the presentation receiver. The use of multimedia in a presentation is one of the main characteristics of multimedia applications (along with interaction with the viewer and computer control of the presentation). All of these media are used to enhance communication. It is proven [3] that the use of multiple channels of communication correctly utilised can be more effective than a single channel of communication. For example, it would be a far more effective educational method to use an image or an animation along with the textual description of a biomedical image or the textual description of a clinical action. Multimedia enhances a software presentation in such a way that communication of knowledge is more effective and efficient.

In the remainder of this paper we present a concise but focused definition of multimedia, the need for regulated BSE training material in the UK, and an approach for developing specifications for a development methodology for a BSE multimedia training application, extending to other equally viable areas of biomedical application.

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Abstract

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II. DEFINING MULTIMEDIA

Prior to our discussion of multimedia applications in the biomedical field, it is important to provide a clear definition for the term *Multimedia*. Unfortunately this is not an easy task, as multimedia means different things to different people [2]. In order to avoid any confusion we shall adopt a definition of multimedia generally found in the literature under the term *Interactive Multimedia,* or IMM. In this way we will avoid any possible confusion and restrict our discussion to "computer mediated interactive presentations that utilize more than one medium".

Thus in today's multimedia world, computers serve two functions: as development tools for the creation of multimedia presentations, and as delivery devices controlling the flow of these interactive presentations [6].

III. TOWARDS A DEVELOPMENT METHODOLOGY

A. Multimedia Software Development Methodologies

Most software development techniques can be used up to a certain extent in the production of multimedia software. However, none of them, individually, would sufficiently address all aspects of multimedia software development. The current state of the art involves a mixture of techniques based on personal preferences and knowledge of the developer. Such techniques are primarily used in multimedia productions without multimedia specific development methodologies being readily available for adoption. Multimedia developers usually "pick 'n mix" software and other development methodologies in order to create a minimum, but sufficient, methodology or approach that fulfills their development needs [7].

The lack of standardized approaches is an important issue that needs to be addressed [8]. It is an expensive and time consuming process for any developer to first establish a methodology and then proceed onto developing his/her multimedia product. Instead it would be much simpler if global multimedia development methodologies were available for adoption on demand for the distinct areas of multimedia product categories, perhaps with minor adjustments for individual projects. The lack of such global standardized approaches is also limiting the productivity of developers and hinders communication among them. The only guidelines available are those dictated on the developer by the software tools he or she is using.

Some attempts have been made at proposing a suitable design/development methodology [9,10] for particular categories of multimedia applications, but the narrow scope of such proposals has limited their usage.

B. Different Aspects of Multimedia Design

Multimedia design expands to many different areas. It is critical to achieve a smooth collaborative integration of these areas in order for a multimedia project to be successful. In the case of educational multimedia the following areas are apparent [6]:

- Graphic, video and screen design;
- Human-computer interface design;
- Instructional and curriculum design;
- Interaction design;
- Storytelling, script and audio design;
- Stage and set design;
- Computer science and software design;
- Practical considerations of the financial and legal aspects of the application.

The management aspect is very significant, as is the developer's role in integrating effectively all of these diverse areas of consideration in one unified successful product.

C. Need for Multimedia-Specific Domain-Special Development Methodologies

It is clear from the literature that there is currently no standard methodology available for the development of interactive educational multimedia applications that encapsulates the totality of the development process [2]. It is understood that no traditional software development methodology can be adapted for multimedia development. This lack of design approaches has been identified and is well documented [3]. A few proposals suggest building a multimedia-specific methodology by looking at methodologies used among the different disciplines present in a multimedia production, and combining them in a way suitable for multimedia applications. Most of what is available today in terms of methodology is exactly of this nature [11]: guidelines combined from different approaches which blend together to address the specific issues of multimedia productions.

IV. BREAST SELF EXAMINATION

Breast self examination is a method for diagnosing breast cancer that can be performed without clinical intervention. Women can perform BSE at their homes as frequently as required. The examination is a simple procedure that aims to identify lumps or other breast abnormalities that might be the early visible signs of breast cancer. Although 80% of the lumps detected through BSE are non-cancerous, nevertheless the exercise ensures that any abnormalities are detected and reported at the early stages of a possible disease. This is especially crucial when dealing with such a predominantly widespread type of cancer amongst the female population. To put this last statement into perspective, the following are some of the UK statistics related to breast cancer [12]:

- 1 in 11 women in Britain will develop breast cancer in her life;
- 34,815 new cases of breast cancer were diagnosed in 2000 in the UK;
- Breast cancer is the leading cause of death for women aged 35 – 54;
- Britain has one of the highest mortality rates for breast cancer in the world;
- Breast cancer kills more women in Britain than any other type of cancer;
- Breast cancer is the most common type of cancer in minority ethnic groups in the UK;
- 14,415 women died of breast cancer in Britain in 2000, 270 women each week;
- 80% of breast cancers occur in post-menopausal women.

Indications are that 90% of breast cancer cases are curable if detected at an early stage, but it becomes increasingly difficult to treat breast cancer if it is not detected early. Although there exist other methods of detecting breast cancer much more efficiently than BSE, like screening (mammography), BSE is nevertheless a "private" non-invasive measure that can be used for early breast cancer detection.

Currently BSE education in the UK is minimal. Our research shows that the UK National Health Service (NHS) has not lent serious thought to promoting BSE education to the female population in the UK. In contrast, American national organisations, institutes and commercial bodies have provided a lot more information and training on BSE. The following data support the above statement.

A. Breast Self Examination in the UK and Other Countries

In the UK there is no official training by the NHS on BSE except for a leaflet entitled "The Essential Guide to Breast Awareness" [13]. A variety of independent bodies have taken some steps towards BSE education in the form of health related websites and online presentations.

In the United States government bodies are providing online training for BSE in the form of websites, leaflets and workshops. The information found on these websites is limited to textual descriptions of the BSE procedure accompanied by a limited number of still images [14,15].

Some private health institutes in the United States have additionally developed BSE training websites and videos [16,17], while videos have also been produced by commercial non-health related organisations.

These data indicate the lack of fully interactive multimedia applications for BSE training. Such training could be more effective using multimedia tools for the reasons we have outlined earlier in this paper.

V. TOWARDS A METHODOLOGY SPECIFICATION

We have made an analysis of the methodology specifications definition process, which we will use in order to establish a complete set of specifications perfectly tailored to interactive educational multimedia. These specifications will then be used to develop a prototype application for BSE training. Figure 1 describes the basis of our analyses for the development of the methodology specifications.

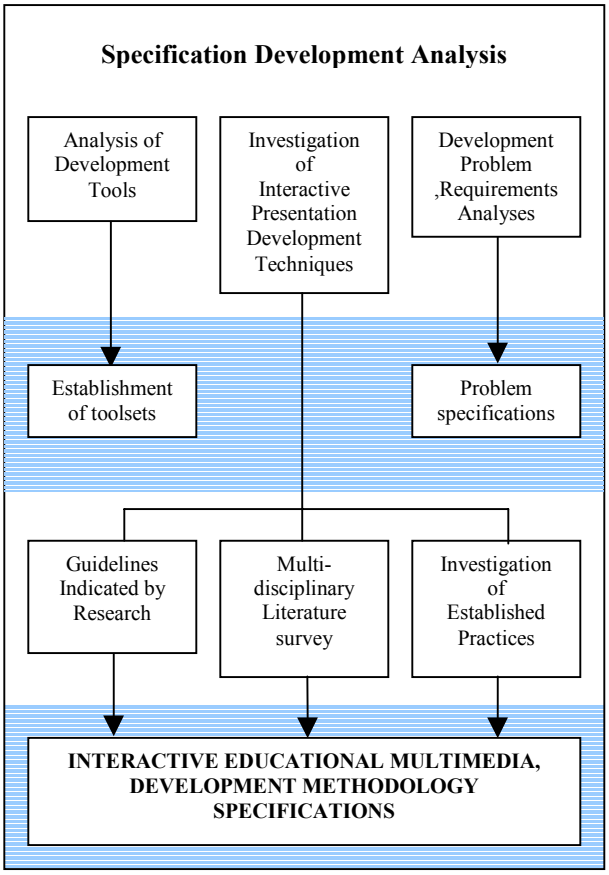

Fig.1. Development of multimedia specifications methodology

Before we can establish a complete set of specifications it is necessary to investigate all the available tools. More often than not, development methodologies depend merely on such tools. Therefore, an understanding of both the limitations and effectiveness of the available tools will provide important information for the development of the methodology specifications.

Interactive presentation techniques must also be investigated. This is a multidisciplinary area that requires research in a number of different fields including filmography, theatre, music, psychology (of learning, communication, etc), teaching methods and other directly or indirectly related areas to interactive presentations. Also to be considered here are the studies and research already reported

and undertaken in the field. Some examples of research work include attention and comprehension studies [5], user interface design and software development guidelines for multimedia. Practices already established by business practitioners also have to be investigated. Usually, approaches developed by practitioners in the field are found amongst most commercially operating multimedia development companies. Some of the approaches in use are the result of years of experience, which will doubtless prove invaluable for the development of the final specifications.

VI. CONCLUSIONS AND FUTURE WORK

The formulation of a complete development methodology that fully addresses biomedical educational multimedia needs is a task that must be undertaken by a multidisciplinary team of research collaborators drawn out of the clinical, engineering and artistic communities. In a first attempt in our paper we have shown the need for a multimedia development methodology and we have described a method for defining specifications for such a methodology targeted at BSE training.

Further work would include the development of other biomedical training applications and constant refinement of our specifications. This should yield to the formulation of a complete and comprehensive set of specifications that will finally aid to the development of a multimedia developing methodology for educational and biomedical educational purposes.

Multimedia education has proven to be more effective, more efficient and more cost-effective than some traditional approaches. Biomedical education could be improved by the use of multimedia. Comprehension and memory recall could be improved as realistic simulation of action descriptions can be achieved [5]. Similarly, interactive and distance learning can be enhanced. We have described a method for building the specifications of a complete development methodology for use in educational multimedia development. Through breast self examination, as a benchmark application, we are attempting to standardize this development approach in order to be able to produce consistently more effective educational multimedia applications in the biomedical arena.

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